DEEP LEARNING FOR FACE DETECTION USING MATLAB

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DEDICATION

This master project report is dedicated to my father, who taught me that the best kind of knowledge to have is that is learned from the life. It is also dedicated to my mother, who taught me that even the largest task can be accomplished if it takes first step.

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Abstract

This project report presents face detection using Convolutional Neural Network algorithm and Deep Learning combination (DCT / DL) throughout MATLAB simulation and modeling. It reveals that the research project has successfully managed to establish an accurate accurate human face detection and crystal-clear human face recognition systems. The system will annul the face image that are tilted, the images on non-human faces as well as the images of human faces that have watermarks. The test results on face tracking when the image has watermarks. Under this condition, it looks like the CNN and deep learning could not identify the image correctly and wrong result is showing for the second image. This indicates that there is a limitation for the CNN and deep learning algorithm. The disadvantage is, it cannot detects the watermark image, as this image is protected. This process will proceed to Convolutional Neural Network algorithm to identify the human face from a given image. If the image belongs to human features then there will be a tracking box marking clearly the appointed face with a yellow square. This marker will be clearly pointing and shaping a yellowish box of the appointed and selected face or image.The novelty of this research project is that the CNN and deep learning (CNN / DL) methods to trace, scan and detect the human face in a very successful and effective manners taking into account the following distinguished features: the face of the human facing to the front view and not tilted or the face does not make any angles unless angels within 5 to 10 degrees only. The face must not be hiding or nor recognizable or positioned on another object. The face must be real and is not printed on any object like wood or plastic. The water mark must not be printed on the face image picture, otherwise the CNN / DL will not recognize it as human face. The working of the algorithm depends on the deep learning where the system needs to learn the image, identify the faces and store the images into database. By creating a folder called image folder, it will be easy for the MATLAB access into the folder to find the images that content human face and none human face. High

resolution for face detection was approximately 85%. The algorithm was able to distinguish between human and non-human faces. By doing this we saved a lot of time in almost half.

Abstrak

Projek laporan ini memperkenalkan "face detection" menggunakan "Convolutional Neural Network algorithm and Deep Learning combination (DCT/DL)" melalui simulasi model MATLAB. Projek penyelidikan ini berjaya menghasilkan pengecaman muka manusia secara tepat dan sistem pengenalan muka yang sangat jelas.

Sistem ini mampu menyahsahkan imej yang tidak jelas, tidak tepat dan mempunyai tanda. Keputusan ujian pada pengesanan muka apabila imej mempunyai tanda. Dalam Keadaan ini, CNN dan "deep learning" tidak dapat mengenalpasti imej secara tepat dan keputusan yang tidak tepat dihasilkan untuk imej kedua. Ini membuktikan bahawa terdapat batasan bagi CNN dan algoritma "deep learning". Kelemahannya, ia gagal mengesan imej "watermark" kerana imej ini dilindungi. Proses ini kemudiannya diteruskan kepada algoritma "Convolutional Neural Network" untuk mengenal pasti wajah manusia. Sekiranya imej tersebut didapati memiliki ciri-ciri manusia, maka akan terdapat kotak pelacakan yang menandakan wajah dihalakan dengan kotak kuning.

Penanda ini akan jelas kelihatan dan membentuk kotak berwarna kekuningan dan memilih wajah atau imej

Projek penyelidikan baru ini ialah CNN dan "deep learning"(CNN/DL)

kaedah untuk mengesan, mengimbas dan mengesan wajah manusia dengan cara yang sangat berjaya dan berkesan dengan mengambil kira ciri-ciri berikut: Wajah manusia menghadap ke arah depan dan tidak miring atau muka tidak membuat sebarang sudut melainkan malaikat dalam 5 hingga 10 darjah sahaja. Wajah tidak boleh tersembunyi atau tidak dikenali atau diposisikan pada objek lain. Muka mesti nyata dan tidak dicetak pada objek apa pun seperti kayu atau plastik. Watermark tidak boleh dicetak pada gambar muka muka, jika tidak CNN / DL tidak akan mengenalinya sebagai muka manusia. Kerja algoritma bergantung kepada deep learning di mana sistem perlu mempelajari imej, mengenal pasti wajah dan menyimpan imej-imej ke dalam pangkalan data. Dengan membuat folder dipanggil folder imej, mudah untuk akses MATLAB ke

dalam folder untuk mencari imej yang mengandungi wajah manusia dan tiada wajah manusia.Projek penyelidikan ini telah berjaya mengesan wajah dan modaliti sistem pengenalan wajah yang tepat dengan menggunakan inovasi CCN dan DL serentak dengan cara yang tepat dan tepat. Sistem ini boleh di industri dan digunakan untuk aplikasi kecurian identiti apabila pengesanan wajah adalah cara yang hebat. Resolusi tinggi untuk pengesanan muka adalah kira-kira 85%. Algoritma dapat membezakan antara muka manusia dan bukan manusia. Dengan melakukan ini, kami banyak menyimpan masa hampir separuh.

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INTRODUCTION

1.0 Introduction

Deep learning is artificial information that reflects the functioning of a human brain in information processing and concept design for use in basic leadership. Learning AI in artificial intelligence (AI) is a subset of systems equipped to record individual information that is not structured or untagged. Otherwise called deep neural learning or deep neural system.

Automation promotes deep learning, which has provided information about all the structures and regions of the world. This equally important information comes from sources such as life on the web, web visitors, internet stages, and online movies. This large amount of information is immediately opened and can be shared via technological applications such as distributed computing.

However, information, which is usually unstructured, is so important that it can take a long time to understand and focus on the relevant data. Organizations understand the incredible potential that can be created by revealing this data and gradually adapting it to AI frameworks for robotic support. Currently, neural and deep adjustment systems provide the best answers to certain problems concerning image recognition, speech recognition and regular language preparation.

One of the basic tasks of the computer is the ability to identify visual content information from an image composed of a grid of raw pixel values. Humans can easily achieve to classify a given image or identify different objects presented in that image. A quick glimpse at an image is enough for us to catch all the important visual details. Humans are able to learn from only a few examples and naturally adapt to a variety of conditions such as brightness, scale, rotation, deformation, angle and so on. Although these tasks seem very natural and straight for- ward for us, it should be noted how difficult these challenges are for a computer. Visual recognition and other machine

vision perception cannot be easily solved by manually designing rules which are used for processing visual inputs. For a computer, an image is represented as an array of numbers and an intelligent system is designed to be able to transform a bunch of structured numbers to high level concepts like “faces”. More- over, not only pixel values for faces from different people are not the same, but also the pattern of pixel In spite of the difficulty of those tasks, we have witnessed the advanced progress in the area of visual recognition. With structured visual input, traditional approaches are trying to figure out effective ways to extract visual features that can preserve useful and robust semantic information as well as important details against different variations. Computer vision community has enjoyed the benefits of powerful hand-crafted features like[1],[2] , [3] and achieved consistent high performance in different visual recognition tasks. More importantly, significant breakthroughs have been achieved in recent years with the advanced development of deep learning. State of the art deep convolutional neural network (CNN) models have the ability to correctly distinguish image categories on large-scale datasets with millions of images and thousands of categories with human-level performance(4) .Other related visual tasks like object detection[5][6][7] , segmentation[8][9] and image captioning[10][11] are also dramatically improved in recent years. A convulsive neural network (CNN) is a type of false neural system used in image recognition and processing and is clearly created to process pixel information.

CNNs are amazing image editing programs, Artificial Intelligence (AI), that provide in-depth knowledge of how generative and magical tasks can be performed. They regularly use image processing with image and video confirmation, as well as recommendation frameworks and NLP (Characteristic Language Handling).

A nervous system is an arrangement of potential devices or programming that is created after the activity of neurons in the human mind. Conventional Neural Network are not perfect for image preparation and need to be supplemented with reduced targets. CNN has gradually lowered their "neurons" like those of the frontal valve, with the area responsible for preparing visual improvements in various humans and creatures. The layers of neurons are orchestrated so that they cover the entire field of view and not differ from the fragmentary image that prepares the problem of conventional neuron systems.

A CNN uses a scaffold similar to a multilayer perceptron, which is designed to reduce treatment requirements. The layers of a CNN consist of an information layer, a floating layer, and a hidden layer containing multiple folding layers, pole layers, fully defined layers, and standardization layers. Removing the limitations and increasing the effectiveness of image preparation results in a framework that is clearly more convincing and less complex for the trains needed for image processing and regular language processing.

1.1 Problem statement

The facial recognition study continues for several years from its biometric feature. Some studies have focused on face recognition to address issues such as continuous accuracy and actualization. This project talks about MATLAB-based CNN face-to-face technology with a graphical user interface (GUI) for customer input. The proposed CNN is able to identify new problems by preparing the final four layers to reduce nervous preparation time. The image pre-processing steps were updated in MATLAB, while the CNN was computed in C (using the GCC compiler).

The most important thing is processing high quality data for a short period of time, with the exception of our Google Advanced Image Search (GAIS) database, in conjunction with our convolutional neural network (CNN) and deep learning (DL) - (CNN / DL) design. Through thorough learning, CNN (Convolutional Neural Network) based face recognition innovations have become a key technology in face recognition and human image recognition. Face detection with exceptional accuracy and productivity, and live video streaming for face capture and data preparation. A research firm can capture face images from video and rare face images, and is prepared to detect non-human images productively. It would work with simple face recognition.m to produce CNN for a new photo and update it for face recognition. Just like Cropface.m, you can trim the look of your photos by preparing data. In addition to preparing the convolutional neural network, the number of targets per grain layer is reduced. Using the built-in newnet for face recognition.

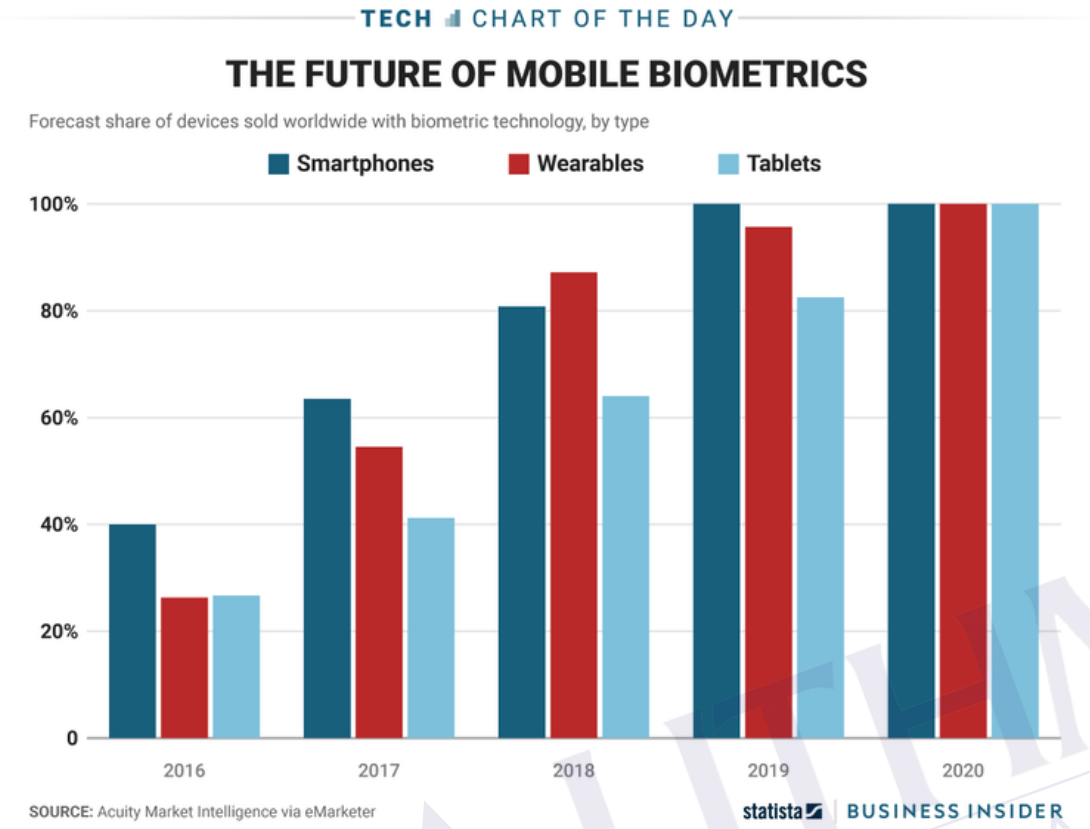

Figure 1.1: Statista biometrics are predicted to be on 100%

This Figure show chart from statista biometrics are predicted to be on 100% of wearables and tablets by 2020, proving that once how significant to have high speed and accuracy face detection.

1.2 Research Objectives

1. To develop the Convolution Neural Network (CNN) and Deep Learning (DL)-(CNN/DL) architecture for human face detection modality.
2. To examine pictures from Google Advanced Image Search (GAIS) database by using proposed-(CNN/DL) architecture.
3. To conduct comparative analysis amid human versus non-human images implementing our projected (CNN/DL) architecture

1.3 Project Scope and limitation

i- Image processing and convolution neural network (CNN) will be used to classify the faces.

ii- Image processing and classification tasks will develop using MATLAB.

iii- A CNN uses a system much like a multilayer perceptron that has been designed for reduced Processing requirements.

iv- There is scope of developing new design mechanisms capable of providing “face Detection" in complex applications.

v- Will use Images from Google Advanced Image Search (GAIS) database.

CHAPTER 2

LITERATURE REVIEW

2.0 Introduction

Chapter 2 is one of the most paramount and influential piece of research among the other parts of any research thesis or dissertation. Having stated that, this chapter will present a comprehensive literature review about other researchers, scholars and scientists who were working tirelessly in the domain of Deep Learning of Face Detection and Segregation using MATLAB.

Comprehensive research work has been done by the distinguished researchers to discuss the issue of deep learning of facial detection and segregation especially using MATLAB. The chapter will commence its quest by defining the face detection, recognition and segregation alongside the deep learning behind it. Then the chapter will proceed to describe the latest research papers, journals and publications that were conducted for the past ten years.

The chapter then will conduct comparative analysis among these researches and extract experiences and the latest innovation established in the domain of face detection by using MATLAB. The literature review (LR) that had been done by the said named researchers, challenges faced by distinguished researchers and the based on challenges, problem identification is marked along with the objectives of the thesis. Finally, the chapter will end its presentation by laying out the summary and the major concluding remarks derived from this LR.

2.1 Definition of MATLAB

MATLAB is defined as Matrix Laboratory program which possesses a programming language as a high-representation language for technical performance [12]. It integrates computation, contemplate, and programming in an easy-to-working area where problems and solutions are state in familiar notations. Standard utilize are following:

- Calculation and approximation.
- Generating set of rules or algorithms.
- Statistics acquire.
- Simulating and prototyping
- Statistics examination and anticipation MATLAB is the computational use decision for research, advancement, and get [12]. It has picture preparing components which are powerful in information treatment.
- MATLAB is the degree of examine condition for every single working field.
- MATLAB has different devices which are utilized in numerical, logical, and designing and so on. It additionally gives a GUI interface.

2.2 Introduction to Facial Recognition

Facial visualization is an important step in the face detection process. As such, they provide a rapid calculation of facial recognition, depending on the design of the Convolutional Neural Network (CNN) [13]. The idea is to catch different kinds of inactive features. Initially, they developed the Adaboost Background filter, which allows the background to be deployed as quickly as possible to improve frame detection speed [13]. At this time, they have consistently and unequivocally used CNN to convey important and important facial features to faces and faces that Adabus has not researched. Of course, CNN can learn and integrate problem-solving elements, individually or in preparation, without making assumptions or using a hand-drawn plan.

Mention or examples of areas used by the example mentioned. Finally, roller vectors (SVMs) are used for recognition, not for CNN's own organizational capabilities [13].
Facial localization [13] is considered the backbone of PC vision and confirmation of change [12,13].
This requires considerable work on facial recognition, facial spot localization, visual appearance and various themes [15]. In all cases, the problem of face recognition remains a challenge due to the presence of light, overhead, semi-obstruction, appearance, and various other causes. The initial stage of the facial recognition framework includes highlighting facial images on vectors. After capturing the image, you can use the different learning calculations to perform the task [16]. Thus, the impact on face recognition computations is mainly based on the selected parameters. In terms of visualizations, many questions are offered by hand-drawn highlighting. This portable coding technique is physically structured based on prior information about the facial image (for example, LBP or SIFT). For example, since Viola and Jones [17] proposed to find the face constant constant, Harry-like indices have been included as a common component of face detection.

2.3 Introduction to face recognition (from traditional learning to deep learning)

The recognition of the beautiful face has reached the position of a leading research group on PC vision and biometrics [18]. Standard approaches based on generated highlights and traditional AI strategies have recently been stopped by deep neural systems created with unusually large data sets. Pr. [18] has introduced an in-depth and revolutionary written review of famous face recognition techniques, which include traditional techniques (based on geometry, all-accented, semicolonial and semi-linear) and deep diffusion techniques.
Face recognition refers to an innovation that can recognize or control the nature of objects in pictures or shots. The most important facial recognition calculations were made in the mid-1970s [19], [20]. From this point on, their accuracy has improved to the point that facing recognition is nowadays more preferable to biometric states than biometric states generally considered to be more energetic, such as unique markings or "iris" [21]. .

One of the factors that make face recognition more attractive than other biometrics is its nonmalicious nature. For example. They expect unique field recognition when customers put their fingers in the sensor, iris recognition expects customers to approach the camera, and speaker recognition counts as customers make noise. In contrast, current face confirmation frames do not expect customers to be in the camera perspective (as they are very good at the camera). This facilitates facial recognition in understanding the biometric method. This also implies that the potential use of face recognition is wider since it is more likely to be mediated in situations where clients are not counting on executive assistance, such as in an exploratory environment. Other common face recognition applications include access control, extortion, personality control and Internet life. Face recognition is one of the most tried-and-tested biometric states when transmitted in unlimited situations, in reality due to the high degree of variability in the face image (such face images are usually referred to as nature). Some of these types include main gifts, maturation, obstacles, lighting conditions and appearance. Examples of this are given in Section 2.1.
Illustration.

Facial recognition systems have changed over the years. Traditional techniques were based on machine-generated reflections, such as edges and surface descriptions (a) (b) (c) (d) (e). Figure.
2.1: Typical breeds can be found on the face of nature. a) The head is present. b) Cor. c) Lighting.
d) Facial behavior. e) Occlusion. Learning strategies such as examining the main body, direct discrimination, or reinforcing vector machines. The problem of highlighting products that are truly salient for the various varieties studied under unrestricted conditions has led researchers to focus on techniques specific to each variety, such as age-invariant techniques [12], [13], current invariant strategies [14], information basic techniques [15], [16] and so on. Traditional face recognition techniques have long been replaced by deep learning strategies that rely on Convolutional Neural Network (CNNs). The main breadth of deep learning techniques lies in the fact that they can be created with extremely large data sets to help the information as much as possible in the discussion of the information. The appearance of nature on the Internet has made it possible to select large-scale datasets [17], [18], [19], [20], [21], [22], [23] indeed. The CNN-based face recognition strategies developed with these datasets have achieved

great accuracy because they can learn from highlights that are true to the current variability in the face portraits used in the composition.

Moreover, the rise in popularity of deep learning methods for computer vision has accelerated face recognition research, as CNNs are being used to solve many other computer vision tasks, such as object detection and recognition, segmentation, optical character recognition, facial expression analysis, age estimation, etc.

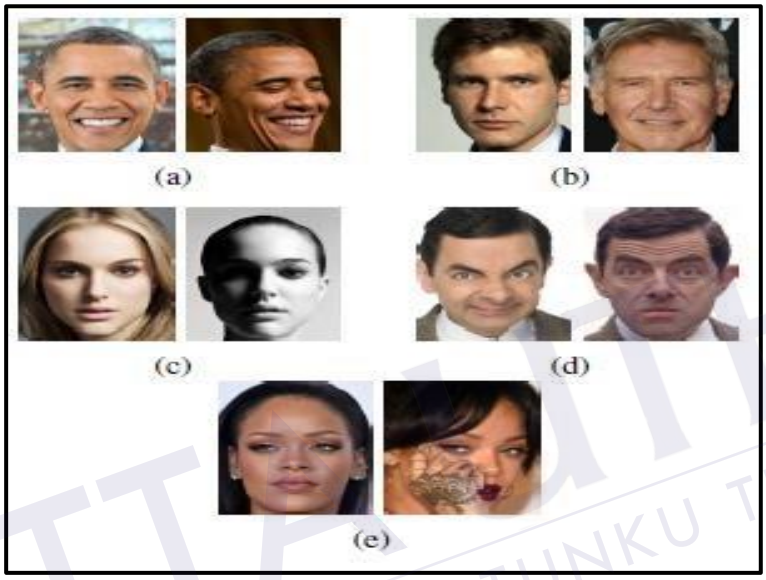

Figure. 2.1: Typical variations found in faces in-the-wild. (a) Head pose. (b) Age. (c) Illumination. (d) Facial expression. (e) Occlusion. [8]

2.3.1 Face Recognition Elements

The elements of face recognition systems can be characteristically classified in the following bricks and can be clearly shown in Figure 2.2

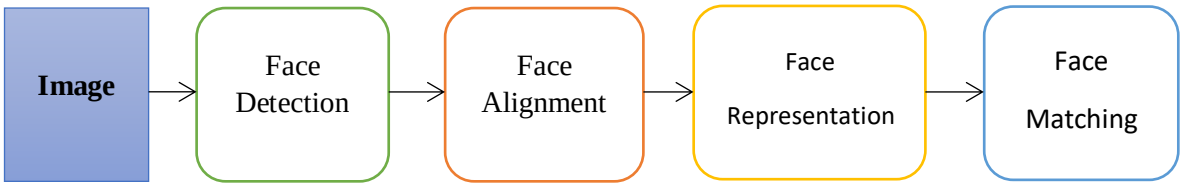

Figure 2.2: Bricks of Face recognition system elements [8]

2.3.1.1 Face detection

A face detector finds the position of the faces in an image and (if any) returns the coordinates of a bounding box for each one of them. This is illustrated in Figure 2.3. [8]

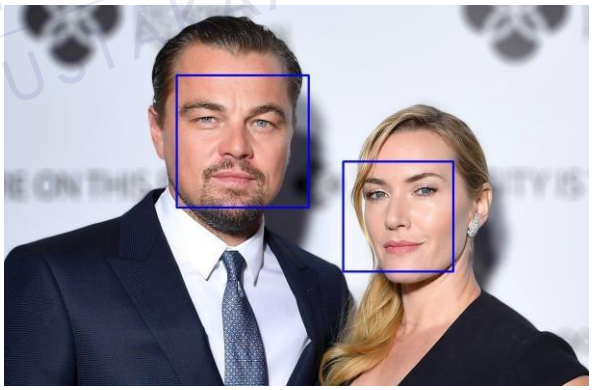

Figure 2.3: Bounding boxes found by a face detector.[8]

2.3.1.2 Face alignment.

The goal of facial consistency is to expand and crop the face image in the same way, using a set of reference points located at a specific location in the image. This process usually requires the detection of a set of facial symptoms with a prominent detector, and if it is easily adjusted to two dimensions, look for an optimal facial inverter that matches the reference point. Figure 2.4 shows the two left and right images combined using the same reference point. The most sophisticated 3D alignment algorithm (for example [24]) can create a facial nose, e.g. Change the face position forward.

Left Right

Figure 2.4: Face alignment (Left) and (Right) Aligned faces and reference points.[8]

2.3.1.3 Face representation

In the facial representation arrangement, the pixel estimates of a face image are changed into a vector of a conservative and discriminating element, also called a format. Preferably, each of the essences of an equivalent subject should yield comparable component vectors.

2.3.1.4 Face matching

Two formats are placed together in the square of the coordination structure of the area to obtain a comparison value that shows the likelihood of having a place with a similar subject. Facial representation is the most important part of a face recognition framework and the subject of the written exam in the corresponding segments.

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